5. Joint Director (Admn.), Directorate of Education, Govt, of NCT of Delhi.

6. Dy. Controller of Accounts, Directorate of Education, Govt, of NCT of Delhi.

7. All Dy. Directors of Education, Directorate of Education, Govt, of NCT of Delhi.

8. All Assistant Directors of Education, Directorate of Education, Govt, of NCT of Delhi.

9. All Education Officers/Deputy Education Officers, Directorate of Education (through their respective Deputy Directors of Ediication), Directorate of Education, Govt, of NCT of Delhi.

10. PS to Director of Education, Directorate of Education, Govt, of NCT of Delhi.

Courses on water management and water harvesting

2010. SHRI K. RAMA MOHANA RAO: Will the Minister of HUMAN RESOURCE DEVELOPMENT be pleased to state:

(a) whether it is a fact that the UGC has decided to introduce courses in Water Management and Water Harvesting in the universities;

(b) if so, whether the syllabus for courses has been finalised;

(c) if so, the details thereof;

(d) if not, whether any expert committee is going to be constituted to look into the finalisation of the syllabus; and

(e) if so, the details thereof?

THE MINISTER OF STATE IN THE MINISTRY OF HUMAN RESOURCE DEVELOPMENT (SHRI MD. ALI ASHRAF FATMI): (a) to (e) According to the information furnished by the University Grants Commission (UGC), the UGC has decided to introduce courses on Water Management and Water Harvesting in the universities. The UGC has framed the syllab. for the courses (Certificate, Diploma and Advance Diploma) in Watershed Technology/Management, a copy of which is enclosed herewith as per statement.

Statement

Certificate Course in Watershed Technology/Management

Earth System:

Earth as a member of solar family. Atmosphere, hydrosphere and lithosphere. Idea about the age and interior of the earth.

Weather and Climate:

Latitudes and longitudes. Weather and climate, atmospheric general circulation. Air mass as weather fronts. Weather elements. Monsoon circulation, types of rainfall distribution. Monsoon through monsoon depressions and tropical cyclones. Recording of rainfall, rain gauge, methods of determining mean areal depth of rainfall.

Introductory Geology:

Geological Time Scale. A brief history of the earth through geological time. Rocks as agreegates of minerals, types of rocks. Main geological formations of India as water bearing strata.

Weathering and erosion. Soil formation, soil profile and classification of soils.

Rocks as layers (beds), their attitude (dip and strike) Use of clinometer compass and Brunton compass. Simple geological structures: Folds, faults and unconformities.

Maps: Topographical maps, scale and its representation. Map reading. Global Positioning System (GPS) and its use.

Geological agents, their erosional and depositional activities. Brief introduction to types of land forms. Study of toposheets: Land forms drainage patters and watershed.

Water Resources: Hydrological cycle. Assessment of surface and groundwater resources. National water resources. Economics of water use, legal control of water use. Need for sustainable water management. NGOs and their role in water management practices.

Ground Water:

Occurrence, Vertical distribution of ground water. Aquifers, confined and unconfined. Water table variations. Perched water table. Porosity

and permeability. Movement of ground water, Darc/s Law. Types of wells. Introductory ideas about the following: Water logging, Conjunctive use of water; Causes for depletion of water table. Water analysis kit and its use. Elementory idea about groundwater exploration.

Water Quality:

Physical, chemical and biological characteristics of water, their significance. Standards for drinking and agriculture water.

Pollution of water: Water pollutants, sources and remedial measures.

Fluoride and arsenic problems in ground water. Graphical presentation of chemical data and its interpretation.

Watershed:

Definition, significance principles and objectives. Watershed

characteristics, causes of deterioration. Principal factors

influencing watershed operation. Introduction to watershed

hydrology.

Water Conservation:

Introductory ideas:

Conservation measures: Gully control, terracing, bunding, check dams; reclamation of soils. Afforestation.

Water Harvesting. Rain water harvesting, roof water harvesting, artificial recharge.

Practicals:

Mean areal depth of rainfall by Theissen polygons and by Isoheytal methods.

Life through geological time: Visit to geological museum.

Study of common igneous, metamorphic and sedimentary rock types. Texture of sedimentary rocks.

Study of types of soils.

Field visit for study of river deposits, terraces, gullies, soil erosion and other features.

Topographical maps. Orientation of maps, map reading, locating of position on the map, use of GPS. Use of Clinometer compass or Brunton compass for location on the map, determination of dip and strike of strata and its plotting on the map.

Interaction with NGOs; their activities.

Use of water analysis kit for determining pH, temperature, conductivity, dissolved oxygen etc. of water sample.

Lab. Work for determining quality of water.

Field study of drainage pattern and delineation of watershed.

Visit to well drilling site and aritificial recharge structures: its description.

Diploma Course in Watershed Technology/Management

Surface Hydrology:

Hydrological cycle, Infiltration factors, infiltration curve and indices. Runoff, stream flow, Methods of estimation of run-off.

Hydrology of droughts, definition and types, combating of droughts.

Causes of floods.

Flood controls: Flood control dams, detention basins, levees, diversion channels, flood channel improvement schemes.

Geomorphology:

Geomorphic processes, endogenic and exogenic. Classification of valleys - drainage patterns and their significance. Morphometric and hypsometric analysis of drainage basin. Watershed delineation.

Ground Water Hydrology**:**

Dracy's Law and its validity Aquifer, types. Steady and unsteady radial flow of ground water. Analysis of pump test data. Aquifer performance test and step Draw-Down Test for determination for aquifer parameters and well-loss (Theis & Jacob's method). Ground Water Estimation Conjunctive use of surface and groundwater. Inland salinity problem and saline fresh interface National Water Policy.

Ground Water Exploration:

Introduction to geohydrological and geophysical methods of groundwater exploration.

Techniques for resistivity method of exploration.

Wells types and their construction in soils and hard rock areas. Methods of drilling tubewells: Cable tool, hydraulic rotary, reverse rotary and DTH (Down The Hole) Centrifugal and borehole type pumps. Development and rehabilitation of tube-wells:

Irrigation Management:

General irrigation development in India, historical review, modern trends. Crop requirements and irrigation scheduling. Major Indian crops, times of sowing and harvesting. Crop selection, depth and Frequency application of water irrigation schedules. Water use of efficiency, cropping patterns. Water conveyance and application methods: Lined and unlined canals, control and diversion structures in field channels and drains, their design. Underground pipe system.

Drip and sprinkler irrigation systems. Drainage: causes of water logging, design of surface and sub-surface drains, saline and alkaline lands. Reclamation and management of salt affected lands.

Soil and Water Conservation:

Characterization and identification of watershed. Soil and Water conservation practices Geotechnical investigation and design of artificial recharge structures: Injection Wells, Induced Recharge structures, Pit/ Trenches and combination of structures. Safety analysis of recharge structures.

NGOs:

Interaction with at least was local Non-Governmental Organizations strongly of their activity and on-going projects.

Pollution and Water Quality Monitoring:

Pollution of surface and groundwater and its health hazards. Preventative measures. Teatment technologies of contaminated water with special reference to fluoride and arsenic.

Practicals:

Field visit for identification of various geomorphic features including drainage patterns.

Analysis of drainage basins.

Estimation of stream velocity and run-off (field).

Estimation of T & S using Theis Curve Type Method, Jacob's Method Determination of stream velocity.

Identification and construction of soil and water conservation structures such as Gully Plugging, Contours Trenching, Check Dams including cost estimation and design (Practical and Field Visit). Soil sampling procedures, visit to chemical soil testing laboratory. Interation with local NGOs engaged in Watershed Programme.

Advanced Diploma in Watershed Technology/Management.

Watershed Management:

Watershed engineering technologies to harness surface and subsurface water. Artificial recharge methods including ASR (Aquifer Storage Recovery) Management of artificial recharge aquifer.

Objective of planning watershed projects, guidelines for project preparation. Watershed delineation, codification. Macro and micro-level delineation, drainage basins.

Project formulation on watershed: Analysis of project elements, need assistance, socio-economic survey.

Watershed resources management with multiple use concept. Project economics Project implementation and management. Watershed impact analysis.

Data Analysis/Modeling/Management:

Collection of data, classification of data, measures of central, measures of dispersion (range, quartile deviation, mean deviation, standard deviation), skewness, Kurtosis.

Probability: Definition, addition of probability theorem, multiplication law of probability. Computer programming. Data base management systems.

Photogrammentary and Remote Sensing:

Definition and terminology. Geometry and types of aerial photographs. Photographic scale. Relief displacement. Photographic mosaics.

Electromagnetic spectrum. Energy source and its characteristics. Remote sensing plant forms and sensors. Earth resources satellites: Land sat, SPOT, IRS Series. Visual image interpretation, key elements; topography, drainage patterns and texture, erosion, image tone, vegetation and land use.

GIS:

Fundamentals of GIS. Components of GIS. GIS technology and application. Raster and vector data. Data input and editing. Data query and analysis. Spatial data modeling, attribute data management. Analytical modeling in GIS.

NGOs and their function:

NGOs: Role of voluntary agencies. Sociology and community participation.

Formation and registration of NGO/Public Trust. Rules and regulations. Liaison with Government Department and Donor Agencies. Formation of village watershed and water-user groups. Functioning of Zila Parishad, Tehsil (BDO) and Gramsabha. Role of women in watershed management. Watershed informatics, data bases and regulations.

Practlcals:

Use of stereoscopes for study of aerial photographs.

Preparation of land use, land cover maps.

Use of software in Water Management.

Digitization of various thematic maps.

Integration and application of GIS.

Close interaction with NGO: Contact programme, field work and studies on type watershed.